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DR. G. P. GIRDWOOD,

Vice-President, Roentgen Society of America.

111 University Street, ... MONTREAL, CANADA.

The American X-Ray Journal.

Devoted to Practical X-Ray Work and Allied Arts and Sciences.

VOL. 8. *ST. LOUIS, MARCH, 1901.* *NO. 3*

ON STEREOSKIAGRAPHY.

By G. P. Girdwood, M. D., Can., M. R. S., Eng., F. R. S. C. F. I. C. &c.

Professor of Chemistry Medical Faculty McGill College Montreal, Consulting Surgeon Montreal General Hospital, late assistant-surgeon Grenadier Guards.

The term stereoskiagraphy implies a shadow picture which gives the appearance of solidity so that every object in the picture stands out in its relative position as regards surrounding objects being made up of the Greek *stereos* solid, *skia* a shadow, and *graphic* a picture and it seems to express what is meant better than the word radiography or stereoradigraphy. A description of the method of taking these pictures is the object of this communication. Stereoscopic vision is due to the fact that we have two eyes placed at a distance of 2 1-2 inches and that each eye sees a different picture from the other. Each eye looking around the near objects as it were and the brain coalesces the two pictures so as to see only one and that one having the appearance of solidity. To produce this result for the surgeon who desires to know the exact position of the foreign body, in any other organism is of the highest importance. This fact came to the author's knowledge in the following manner. A skiagraph was take of a hand of a young woman who was an out patient at hospital, and the skiagraph showed a piece of a needle between the ring and middle fingers. The same young woman had also a needle in the arm of the same side, in position perpendicular to the shaft of the humerus about the middle and running in from the back of arm.

A month after another skiagraph was taken of the same hand when three pieces of needle were found, seen in the interspace between metacarpal bones of middle and ring finger. The attending surgeon realizing an hysterical patient told her if she wished to make a pin-cushion of herself she could do so, but he would not take them out. The surgeon went off duty and another took his place, and seeing the second skiagraph he undertook to remove the fragments. Of course the supposition was that these pieces of needle were in the palmar surface, but when the surgeon came to operate he found them on the dorsum of the hand. From this case the author realized the necessity most urgently of locating more exactly the position of such foreign bodies and having tried various methods of cross wires, rectangular pictures from two points at right angles and remembering the beauty of stereoscopic pictures the author determined to make a stereoscopic picture, and was so pleased with the results that he now always takes his pictures stereoscopically, with the result that the exact location and position of the

foreign body is at once made evident.

The manner of taking these skiagraphs is to adjust the tube over the part as near as may be right over the foreign body. The target of the tube is placed parallel to the table on which the plate is laid. The plate wrapped in paper impervious to light is laid on the table, then the part to be skiagraphed. The tube is placed twelve inches above the skin of the part. A plumb ball is held over the part and the tube is brought to such a position that the platinum target is 1 1-4 inches to one side of the plumb line then it is rotated so that a normal to the platinum target will fall on the spot where the plumb ball touches, and a picture is taken. A second plate is slid under the first till in the same position when the first plate is removed. The tube is then moved to a position 1 1-4 inches to the other side of plumb line and the platinum target is so placed that a normal therefrom shall strike the same point of skin as in the previous position, and a second picture is taken. The two pictures will be fac similes of the pictures that would be seen by the two eyes at 12 inchees distance and conveyed on the spot where the point of the plumb bob touched the surface and would give an absolute position. Of all objects seen it will be evident from the pictures here shown that all these objects take their proper relative positions and the distance of one from the other can be readily measured. As these cases often require immediate operation and the surgeon is desirous of rapidly seeing the position of the parts the two pictures may be at once, as soon as fixed, placed in a frame with a ground glass background illuminated and viewed in Wheatstone's reflecting stereoscope which any one can make by obtaining a couple of square pieces of mirror about 4 inches square and fitting them together so as to form a right angle, then by putting the nose opposite the junction, each eye will look into each mirror and if the two pictures just taken as above described be placed at right angle to a line drawn through center of both mirrors and at a distance from each mirror of from 10 to 12 inches the image for each eye will be presented to it and the picture will appear as a solid, every part taking its proper place and relative distance. If it is desired to obtain a print it may be done by taking the negative when wet, just after fixing and washing; a sheet of velox paper or some other developing paper may be moistened and applied to the still wet negative and exposed to gas light or any other light and developed in the ordinary way, and when fixed may be laid on a sheet of glass still wet and put into the stereoscope and viewed. If it be desired to reduce the picture to the ordinary stereoscopic size 2 1-2 to 3 inches square the original negative may be put up in a window with a good white backing and a reduced photograph taken in the ordinary way by camera of each picture. These may be printed either in the ordinary way or by development paper and then mounted on a stereoscopic card mount and viewed in the Brewster refracting stereoscope. In taking and in viewing these pictures and prints it is necessary to be particular in the various processes of copying and printing to bear in mind the various changes of reversal due to the printing and copying. The great advantage of this process to the surgeon is that if he mount the pictures with right eye picture, to the left eye, and the left eye picture to the right. and vice versa, he will be

Uo-to-date doctors do not want any new work on surgery

able to obtain a view of the same object from both back and front so that he may be the better able to judge of the distance of the relative objects.

The Wheatstone's reflecting stereoscope has been described above. The Brewster refracting stereoscope may be easily made by buying a pair of pneumatic lenses which can be bought for about 40 cents and mounting them between two pieces of black cardboard with the board edge to the outside and the thin edges together and the centers of lenses 2 1-2 inches apart, then holding the lenses so that the axis of vision and of lenses should be in the same line and holding the picture at the proper focal distance of the lens a stereoscopic picture will be seen readily by any one whose eyes are of equal power. If, however, the individual is troubled by wearing spectacles it becomes necessary to be careful that the axis of the eye spectacle and lens of stereoscope all be in the same line. In an ordinary case of a needle in the hand the skiagraph only shows the needle lying flat on the same plane as the bones on the paper, but if seen stereoscopically it will often be seen as standing right up in the hand in the very direction in which it has been driven in. In case of monstrosities at birth, where it is desirable to know what is the nature of the skeleton without, or before dissection the whole structure may be ascertained by stereoskiagraphs being taken, and by reversing the pictures both back and front views can be obtained. Specimens of these kind of pictures are here shown and the stereoscope necessary to see them.

As a means of locating objects the stereoscope is far better than any other means. Dr. MacKenzie Davidson, of London, England, has just completed a stereoscopic fluroscope. As yet the author has not seen one' but it is claimed for this instrument that the foreign body can be seen distinctly in its proper position and that a probe or knife can be seen exactly in its relative position and that an operation can be readily performed and the point of the knife watched all the the while. If this turn out to be so satisfactory an adjunct to surgery, it will revolutionize surgery.

111 University street, MONTREAL, CANADA.

We have recently read from a book review in the Annals of Surgery, "A Manual of Surgical Treatment, by W. Watson Cheyne and F. F. Buyhard." These are the words: "As in the preceding volumes, there is some tendency to dwell too much on certain old-fashioned apparatus and procedures, while some valuable modern methods are either treated too briefly or not at all. Although the x-rays belong properly to a treatise on diagnosis, it is surprising that this adjuvant to treatment fails of mention in this work." We predicted two years ago that any author offering a work without full credit given to the diagnostic advantages of the x-rays would find limited sale and would be classed amongst the rehashings of obsolete literature. A publisher that will put forth a work ignoring the chief tenets of its importance must feed on obloquy.

Leonard states without reservation, that stone in the kidney will be affirmed if present and negative upon the photographic plate if absent, provided always, of course, the proper tube is used and the proper radiance obtained. This must sound very strange to those who write so learnedly upon the "fallacies of the x-rays."

that fails to recgonize the importance of the x-rays.

STEREOSCOPIC SKIAGRAPH OF MONSTER.

The skiagraph of these monsters was made by Dr. Girwood, of Montreal, and sent to the AMERICAN X-RAY JOURNAL on account of their stereoscopic effect.

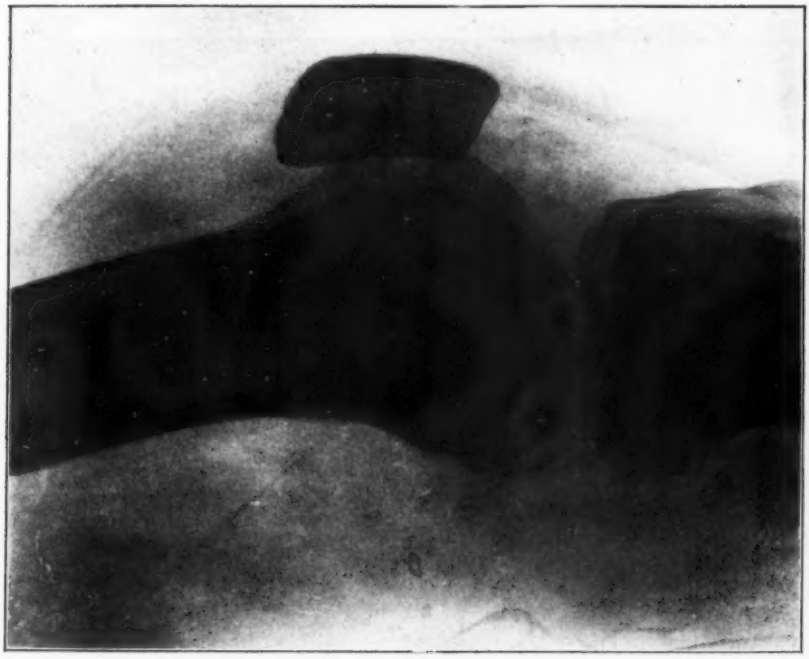
The skiagraph is taken stereoscopically, the two pictures being taken from two points 2 1-2 inches apart, and when mounted in one way shows the front view, and when reversed, the back view is seen. Of course, when mounted they are stereoscopic. If mounted one way one picture for right eye and one for left they give a posterior view of the fœtus as if it were walking away with shoulder in the middle, standing well out and the knees bent away from you. If, however, these pictures are reversed the view is from the front and the ribs project toward you and so do the knees.

DISTINCTION OF GALL STONES.

The reprint by Dr. Carl Beck, from the New York Medical Journal, "on the detection of Calculi in the Liver and Gall Bladder" together with additional skiagraphs, is a valuable contribution to x-ray literature. Several cases are shown skiagraphically of gall stones in the body. Plates showing different constituents of calculi are very well done. The doctor says: "We distinguish common biliary, pure cholesterin, stratified cholesterin, pure bilirubin, and mixed bilirubin-calcium calculi. The calcium carbonate is also found and gives the greatest distinctness."

Lieutenant F. Brice of the British army read a paper before the Roentgen society of London, 7th ult. on "Experiences of X-Ray Work during the Siege of Ladysmith.

The sage of maturity is always out. The Roentgen Society



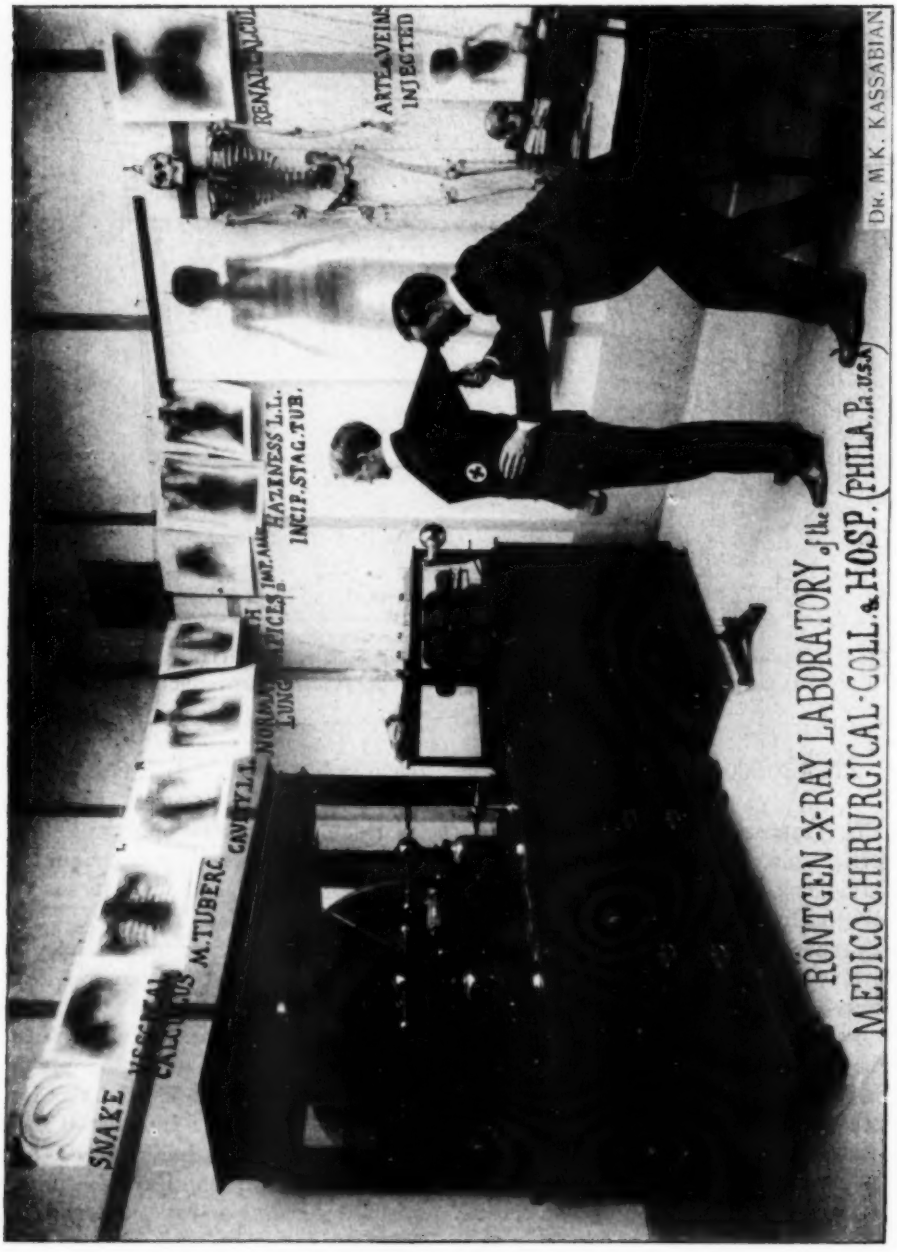
X-Ray Picture of Knee Joint, Taken by Dr Pitkin, of Buffalo, to Demonstrate the Attainment of Detail or Contrast in Modern Radiography. See January Number of this Journal.

STEREOSCOPIC FLUOROSCOPE.

This instrument as described by its maker or inventor, Mr. Makenzie Davidson: "Consists of a fluorescent screen illuminated by two tubes, which are sparked alternately. A rotating disk with appropriately placed slots eclipse each eye alternately. This works synchronously with the sparking of the tubes. Each eye sees the shadow cast by the one tube. A stereoscopic image is thus seen on the screen, the movements of the shutter, etc., being sufficiently rapid to give a continuous illumination of the screen. Those who desire to read up the methods for stereoskiagraphy should study the admirable paper by Dr. Girwood, of Montreal, in the November number, 1900, Vol. 7, No. 5, of the AMERICAN X-RAY JOURNAL, and also of thisissue. An understanding of stereoskiagraphy makes you acquainted with the principles of the stereoscopic fluorpscope.

The New York Orthopædic Dispensary and Hospital is a worthy charitable institution and deserves the countenance of all philanthropic persons. Their Thirty-Third Year Book is out and is a fair illustrated exponent of the institution. If the same pictured wards, etc., had been substituted for fine x-ray pictures of deformities taken before and after treatment their little folder would have been immeasurably more interesting and useful to every body.

of the United States portends danger to his business.



X-Ray Laboratory, Dr. M. K. Kassabian.

The pessimist sees no room for the Roentgen Society

TECHNIQUE OF X-RAY WORK.

Read before the Roentgen Society of the United States, Grand Central Palace, New York City, Dec. 14, 1900.

By Mihran K. Kassabian, M. D.
Skiagrapher to Medico-Chirurgical College and Hospital, Philadelphia, Pa.

Mr. President and Gentlemen:—I feel highly honored in being permitted to read a paper at this first regular meeting of the Roentgen-Ray Society of America, many of whose members have attained world-wide celebrity as specialists in one department of science or another, and in assuming the responsibility of the task I have undertaken, I would have it clearly understood that I am fully conscious of the smallness of my own claims to be heard on a subject so important to the public generally, and to medical practitioners in particular, as x-ray photography has already proved itself to be in the past, and is likely to become in the future. Nor would I have undertaken the task, had I not felt some assurance that the lessons I have learned during a practical experience of eight years in photography, and of several more in skiagraphic work in hospital and United States government service in 1898, may prove serviceable to others also.

Since Prof. Roentgen's famous discovery, I have made more than eight hundred x-ray negatives, and 3000 fluoroscopic examinations, some of which I need hardly say, were failures, but not altogether valueless on that account. In fact, failures in scientific investigations are often the greatest and most efficacious teachers. For a knowledge of what to avoid is frequently of the utmost inportance, especially in work of this character.

In treating the subject of my paper, I shall feel myself under constraint occasionally to enter upon domains of science, where, undoubtedly, many gentlemen present are far more at home than myself. But I trust these little trespasses will be overlooked, and their occurrence viewed as entirely unavoidable.

Need of Experience in Photography.—At the outset I would impress on the x-ray worker the importance of a thorough knowledge of photography, since without that he can hardly hope to succeed in obtaining a satisfactory negative. Moreover, it is very important that he accustom himself to developing his own plates, since if he sends them to a photographer for development, the latter will be liable to under-develope or over-develope them, owing to his ignorance of the case, he does not know exactly what he is aiming at; and besides this the operator does not gain experience as to the time of exposure. And again the patient might be from a distance, so that a quick diagnosis would be of the utmost importance. Few surgeons and physicians can either see or understand anything in an under-exposed or under-developed negative; and even when the negative is good it requires an experienced eye to take in and appreciate all its details. Hence clearness in the negative is essential to the practical usefulness of skiagraphy in surgery and medicine. And what the negative is, the resulting print must also be.

Fluoroscope versus Skiagraph.—There are two methods of examining a case with the x-rays, both of which are important and useful, yes, necessary since they confirm each other; namely, fluoroscopic and skiagraphic.

It may be noted that there are great diversities of opinion among x-ray workers regarding the relative values

so long as he is holding the hoodwink.

of these two methods. As a matter of fact, however, they both have advantages and disadvantages, which I will endeavor to set forth in detail as results of my own personal experience and observation.

1. The fluoroscopic examination is merely temporary, while the view is limited to few individuals. On the other hand the skiagraph is a permanent record, visible to everybody, and moreover, capable of use in legal cases, the lecture room, clinics, etc.

2. Fluoroscopy, however, is easy, quick and affords ready facilities for comparison with the normal corresponding part. In these respects it has an advantage over the skiagraph, which requires considerable time to effect, and is more tedious.

3. Fluoroscopy also has an advantage when the heart, joints and respiratory movement are concerned; as it offers better opportunities for studying them, and from different directions, when necessary. The skiagraph shows a blurred effect in the case of moving organs.

4. Fluoroscopy is at a disadvantage when the pelvis, kidney, spine and deeper tissues are to be examined; but the skiagraph shows them plainly.

5. A fluoroscopic examination, again, fails to reveal small foreign bodies in the bony part—as shot in the eye, for instance—but the photoplate differentiates by relative density and therefore shows them distinctly.

6. The Fluoroscopic examination shows only indistinctly incipient changes in the bony part (as callus, exudation, floating cartilege in the joints); whereas the skiagraph shows them clearly by differentiation, (provided the vacuum is suitable).

7. In an impacted fracture, also, as there is no displacement or separation, the relative density is unaltered, fluroscopy is of little service; but the skiagraph shows it clearly even through the splint, or plaster of paris, if any is present.

And now, to revert again to the negative, I would direct special attention to a few points of vital importance to success in the effort to secure that clearness of detail which alone determines its practical usefulness.

VACUUM.—It being presumed that the general condition of the x-ray apparatus in use is satisfactory, the operator must see to it that the degree of vacuum he is working with is suitable to the case he has in hand. For fluoroscopic purposes a high degree is usually necessary.

PRELIMINARY FLUOROSCOPY.—All being in readiness, he should first make a fluoroscopic examination of the body or part affected, between which and the focus tube a black screen has been interposed to exclude the surrounding light. This examination must be thorough, since on it depends in great part the success or failure of the subsequent work.

As a case in point, let us take a joint. View it from different directions, and, moving it, compare carefully with the normal corresponding part.

PLATE.—This over, take your plate, and put it into the usual envelope of black paper, making sure that the gelatine side is upward, i. e., toward the smooth side of the envelop. Use a piece of blotting paper or silk to prevent its getting wet from perspiration of the part pressing on it.

POSITION OF PATIENT.—The patient must be placed in such a way as to secure comfort, so that there may be no undue tendency to movement of the part affected during exposure. This

part, divested of clothing, must be covered with an oiled silk cloth without wrinkles, and brought as near to the plate as possible, an aluminum sheet being interposed and connected with the earth.

In case of foreign bodies in the eye, put the patient in a chair, and use a head-rest, which I find more convenient, and produces less tendency to disturbance of the part either by its own movement, or by ordinary respiration, than if he were reclining.

POSITION OF CROOKE'S TUBE.—The arrangement just spoken of has presumably been made with due regard to the position of the Crooke's tube.

Now it is positively known that the x-rays are both divergent and rectilinear, wherefore even slight carelessness on the part of the operator may cause much distortion and disproportion, or over lapping of bones in the plate. Hence the part to be examined must be placed in the center of the plate; and the platinum disc of the focus tube must be directed to this center, perpendicularly to the center of the hemisphere of x-rays generated.

DISTANCE OF TUBE.—Put the tube as far as possible from the part within a limit of four feet; and remember that the farther the tube, the longer is the time of exposure required, which is somewhat of a disadvantage, but this disadvantage is more than counterbalanced by the increased sharpness of the shadows obtained.

TIME OF EXPOSURE.—As we have just seen, the time of exposure depends on the distance of the tube, but this is only one of several determining causes to be considered. It depends also on the degree of vacuum, and on the resistance met with—as, for instance, the thickness or density of the part to be examined; the presence of splint, plaster of paris, etc.

DARK ROOM.—Assuming then that due care and attention have been given to these details, the next step is to remove the plate to the dark room, which should be located as near as possible to the x-ray room. And there I propose, with your permission, to leave it for a time, while I offer a few remarks on the very important subject of light (solar, white) and photo-chemistry. In doing this I will endeavor to be very concise, and to confine myself to such matters as bear directly on the technique of x-ray work, and are necessary to a clear understanding of the operations it involves.

IMPORTANCE OF A KNOWLEDGE OF PHOTO-CHEMISTRY.—At the close of the 19th century, we no longer believe in empiric formulae, nor do we place a blind, unreasoning faith in the scientific teachings of our ancestors, however eminent they may have been in their day and generation. As physicians, we must know the chemical and physiological action of the remedies we employ or advise. When we prescribe or administer a drug, we must have a clear notion of its most probable effects on the economy and different organs of the body.

Many photographers, undoubtedly, take and develope pictures by a merely mechanical process, with little or no knowledge of the scientific principles on which their art is founded, and by which alone it can be advanced and perpetuated. To such a one, any irregularity in results presents almost insuperable difficulties, which might easily, or at least more certainly and readily be overcome by a knowledge of what is taking place among the chemicals he uses.

In a word, a knowledge of photo-

chemistry, or the want of it, makes all the difference between the master of his art, who makes his processes the slave of his wishes, and the mere mechanical operator, who is the slave of formulae.

LIGHT.—A knowledge of the nature of light is not of less importance than chemical action to ensure success either in photography or skiagraphy.

In the case of a photograph, the reflection of light from the different objects falls over the sensitive plate in a reversed position; whereas in the skiagraph the shadows fall directly on the plate. We do not know the exact relationship of the so-called x-rays, notwithstanding the many theories which have been broached, but we do know that their action on the photographic sensitive plate is the same.

ACTION OF LIGHT.—A ray of white light has two modes of action, (1), photo-physical and (2), photo-chemical or actinic.

The first calls for merely a passing notice, since it is of little importance in photography. The effects of its chemical action, however, are apparent at every stage of progress in the photographic art; and therefore the cause of such action, and the precise mode of its operation should be diligently sought for.

"In many cases the cause of chemical action may be found in the physical explanation of the nature of light, or radiant energy, the undulations of which it is supposed to consist, exerting their energy in bringing about chemical action, or decomposition."

For our present purpose we may assume this undulating theory, with the chemical theory that bodies are composed of molecules, which are not only themselves in a continual state of oscilatory movement, but whose constituent atoms are also subject to an inter-molecular motion of a similar kind. The principle here involved is that of the superposition of small impulses.

Such impulses repeated at regular and suitable intervals may produce a considerable effect by creating a new molecular and atomic movement in substances resulting in chemical changes.

In fact, when light is absorbed by a body, whether wholly or partially, it must have done work of some kind. In general, perhaps, a rise of temperature results, but in especial cases the effects upon the atoms and molecules may cause them to enter into fresh combinations.

OXIDATION AND REDUCTION OF LIGHT.—We know from observed cases that the chemical action of light may be that of oxidation or reduction; or it may produce decomposition or photo-dissociation.

The haloid salts of silver are those upon which the action of light is the most important, but it is not yet determined whether this action is one of reduction, or oxidation, or what it is.

CHEMISTRY OF DEVELOPING PROCESS.—We now proceed to the developing process, in which manipulative skill born of long practice and an intimate knowledge of chemical principles will both be found of service.

It is only in exceptional cases that photo-chemical action of light produces on the sensitive film any visible alteration. The image "photographed" on it is usually invisible, or latent. The light having done its work, means have to be found by which the change in the photo-sensitive plate may be made visible. This process is called "developing," and the agents used in the operation "developers." The

action of the developers is in the main chemical, and their varieties are legion, but the chief ones are acid and alkaline.

In alkaline development the image grows by continual reduction of the silver haloid downward, as may be seen by the image only becoming visible towards the end of the operation; consequently, when the silver is removed by acids, a sunken cast of the image is left in the gelatine.

The use of Potassium Bromide as a "restrainer" probably rests upon the the formation of a double salt between it and the silver bromide, this double salt being less reducible than the silver haloids alone.

"The "accelerator" is sodium carbonate, or caustic soda, which act by opening the pores to let the reducing agent into the gelatine.

DEVELOPERS.—I will now explain briefly the various actions and modes of action of the chief agents used in development, although the doing so may involve some little repetition.

The "developers," as has already been explained, are those re-agents which bring out the invisible image by reducing the oxidized haloid silver salts. The alkaline developers play a very important part indeed, owing to the diversity of their modes of action.

REDUCER.—(1) Some of them are reducers, or density givers, as pyro, metol and hydrochinon.

No. 1.			Metric.
Metol.....	½	ounce =	15.50
Hydrochinon	⅜	" =	11.65
Sodium Sulphite (crystal)	7½	" =	233.00
Distilled water.... 120		" =	3600.00
No. 2.			cc
Sodium Carbonate (crys)... 4		" =	15.50
Distilled water.....30		" =	900.00 cc

For developing, take four parts of No. 1 and do not add No. 1 in full proportion, viz., one part. But begin with small amount, if necessary, dilute for summer season on large plates, renew the No. 1, if necessary. *Vide* "Modus Operandi of Developing." 10 per cent bromide potash.

ACCELERATORS.—(2) Others are accelerators, which act by opening the pores of the gelatine, thus setting the reducer in action with an energy proportional, within certain limits, to the amount of acceleration, as amonia, sodium carbonate, or caustic soda.

RESTRAINERS.— (3), Others, again, act as restrainers, as potassium bromide, which retards the action of the reducing agent.

PRESERVATIVES—And (4) some act as preservatives as sulphite of soda, or citric or other acid.

PRACTICAL HINTS.—If the operator will observe and carry out the following general rules of procedure, he will seldom fail to attain the end he is aiming at.

1st. To increase the rate of development, use a concentrated developer; increase the proportion of the accelerator, reduce the proportion of the restrainer; and increase the temperature.

2nd. To retard development, dilute the developer, reduce the proportion of the accelerator; and increase the proportion of the restrainer.

3rd. To increase (contrast); reduce the proportion of the accelerator and increase that of the density giver and restrainer; increase hydrochinon.

4th. To reduce (contrast); reduce the proportion of density giver and restrainer; increase that of the accelerator, and dilute the developer.

MODUS OPERANDI OF DEVELOPMENT.—We now come to the detailed process, or *modus operandi* of development, which, of course, is conducted in a room from which all white light has

of the funnel, is a philanthropist and widens into the uses of the x-ray

been carefully excluded. A small red light may be used to enable the operator to see what he is doing.

Arrange your developers and accesories in separate bottles, marked 1, 2, 3, etc. Then take tray and measure number 1, (metol) (reducer) into one graduate, and number 2 (accelerator) into another. Then take your plate from the envelope, handling it carefully, and being cautious not to bring it too near the red light. Dust it, and put it into the tray, gelatine side upward, over a plate-lifter. In the case of a large sized plate, it is better to moisten with distilled water, or old developer, to avoid air bubbles, and prevent the patches which may be produced by the strong developer; but for 8x10, or 11x14 size, this precaution is not necessary. It is advisable to use first the old developer, then pour it out, and use the new one, if necessary. Pour number one developer from the graduate glass into the centre of the plate, and rock the tray.

Do not keep too far away from the red light at the beginning, or you will not be able to see whether the developer is being evenly distributed, or is leaving patches. When you notice that it is even, move to a distance of two or three feet from the light, and watch the plate. The time that elapses between the beginning of the developement and the appearance of the picture cannot be definitely fixed, but it is usually ten, twenty or thirty seconds, according to circumstances. You notice first the exposed part of the plate, that is, the part that has not been interposed between the tube and any matter, grows darker and darker; then the muscles or other easily penetrable parts begin to appear in the picture. If it seems to be slow, use a little alkaline by bringing the solution to the corner of the tray and pouring in the alkali (No. II), mix well before rocking the tray. If the picture appears suddenly, use two drops of potassium bromide 10 percent as a restrainer. Do not examine the plate very often by transmitted light, as it may cause fogginess.

The duration of developement depends on several circumstances, as, for instance, the season, or the temrature of the solution or of the room. Development is more rapid in summer than in winter. It is affected also by the part of the body taken, since the thicker and deeper tissue continues until the negative is entirely dark, and opaque in transmitted light, in which case it may be advisable to wash the negative, and renew the developing process.

FIXING.—After the developer has done its work, there still remains a portion of unaltered sensitive salt which must all be removed before the plate is brought into the light. This process is called "fixing", and is effected generally by the use of "Hypo", but sometimes it is advisable to employ "acid fixing". In order to prevent any after-staining or yellow color, it is better to leave the plate in the solution five or ten minutes after it has been apparently fixed. The fixing is followed by washing the plate in running water to remove whatever chemicals may be still adhering to the gelatine film. This final process, like all the previous ones, must be thorough. I find it of assistance while washing to rub the plate gently with absorbent cotton. The patience of the x-ray worker, especially, is sorely tried during this final operation, as he is naturally anxious to learn whatever secrets the plate may have to disclose. The

water, however, must be allowed sufficient time to remove the last vestiges of the persistent Hypo from the film. But in this, as in all mundane things, the end comes at last, as we assume it to have come now in the case of our negative.

FAULTS IN THE NEGATIVE CAUSES OF NON-SUCCESS IN PLATE. — Whenever faults, as often happens, are found in the negative after development and fixing, they are generally due to one, or another, or a combination of the several causes enumerated by Mr. Cramer, the manufacturer of photo and x-ray plates, whose long experience in, and through knowledge of photographic work, enables him to speak authoritatively and exhaustively upon the subject. What he says has immediate reference to photographic plates, but with very slight and self-suggestive changes, his remarks are equally applicable to x-ray negatives. These faults with their causes are:

(*a*) *Foggy negatives*, over exposure, white light entering envelope, too much light during development. Fog may also be caused by decomposed developer; introduction of hypo or Nitrate of Silver into the developing solution; developer too warm or containing too much Carbonate of Soda, or Potassium, or Bromide.

(*b*) *Weak negative with clear shadows;* Under development.

(*c*) *Too strong with clear shadows;* Underexposure.

(*d*) *Weak negative with plenty of detail in the shadows;* Over exposure, or too weak developer.

(*e*) *Too much intensity;* Developer excessively strong, or too warm.

(*f*) *Fine transparent lines;* Using too stiff a brush in dusting off the plate.

(*g*) *Round transparent spots;* Air bubbles in developer.

(*h*) *Transparent spots of irregular shape;* Caused by dust. Keep the camera and tablet free from dust, and brush off the plate carefully before placing in the holder (envelope).

(*i*) *Yellow colored negative;* Decomposed pyro solution; insufficient or decomposed sulphite of sodium in developer.

(*k*) *Yellow or brown stains, iridescence of surface;* caused by using the developer warmer or stronger in alkali than the plate will stand; also by plain hypo solution which, by continued use, has assumed a darker color; or by insufficient fixing. The stain may be removed by applying the reducing solution and the iridescent surface can be wiped off with a tuft of cotton while the negative is wet.

(*l*) *Mottled appearance of negative;* Precipitation from the fixing bath containing alum, if the solution is old or turbid.

(*m*) *Crystalization on the negative and fading of image;* Imperfect elimination of the Hypo.

FAULTS RECTIFIED BY (1) REDUCTION.—The remedies for several of the foregoing faults are given in their respective places, the omissions I will endeavor to supply here. The density or darkness due to overexposure or over development may be rectified by using potassium ferrocynide with the Hypo."

OR (2) INTENSIFICATION.—On the other hand, when the negative is weak, that is, wanting in density due to insufficient deposit of silver caused by under-exposure, or under-development, it requires intensifying or strengthening. The favorite intensifier is mercuric chloride. On covering the wet negative with a solution of this compound, the silver deposit is

bleached, the mercuric chloride being reduced to white mercurous. After washing off the excess of the intensifier, the plate may be treated with a dilute solution of ammonia, which gives black mercurous ammonium chloride, thus adding greatly to the density of the negative.

INTERPRETATION. — The plate is finally dried, and brought into the light. It remains now to interpret it. And the power to do this unerringly results from long experience, aided by such anatomical knowledge as enables the operator to detect at once any abnormal appearance in the part or parts of the body depicted. His further special knowledge may enable him also to comprehend its full significance. The totality of this combined knowledge and experience determines and establishes his position as an x-ray worker. Neither the experienced photographer nor the skilled surgeon or physician can see what he sees in the plate, and what he sees he can show and explain to others by his acquired powers of interpretation. Do not be prompt in diagnosis, study the plate carefully.

PREPARATION OF MATERIALS.—Before closing I would offer a few practical suggestions which may prove serviceable to the inexperienced worker; however superfluous others may think them. In the first place, it is important to remember that the greatest care in the preparation of chemicals and solutions is needed.

Use either distilled water or ice water to avoid impurities, such as carbonates, etc.

It is advisable to use the formulæ of the manufacturer of your plate.

Chemicals must be C. P., such as are prepared for photographic use, and you should know their relative strength.

Bottles must be labeled, and colored bottles light proof, and well corked always. Filter your solutions. Remember in this connection also that cleanliness is paramount.

SELECTION OF PLATES.—I generally use plates manufactured expressly for x-ray purposes. I have tried Eastman's Bromide papers and films, but they do not give satisfactory results. It is advisable to use always the same plate and solutions, when once you are satisfied.

The large skiagraphs (of tuberclæ lungs, 14x16) which are on exhibition here with the Roentgen Society are made on Carbut's x-ray plates, as are also some of the small ones. But I am now using Cramer's special x-ray plates. They are reliable and give richer details.

PRINTING.—As to the printing, that is quite a simple process, and involves nothing the skiagrapher can claim as special. Moreover, since the negative shows more details than the print contains the latter's value consists chiefly in its greater convenience for handling and for exhibition and class purposes. This being the case, any enlargement on the processes, beyond that enough details should be printed to show the part affected, and that a light print is better than a dark one, would be quite beyond the scope of a paper that is discussing the "technique of x-ray work." And I feel that I have already trespassed too much upon your valuable time. But before concluding, I would like to dwell for a moment on the present conditions and the future possibilities of skiagraphy not with any view to marking their limits, or suggusting their nature, but rather to draw attention to their vastness and their supreme im-

portance to science and humanity. The imagination may be aided to comprehend somewhat of their significance by comparing "small things with great." The "Fathers of Photography," Daguerre and Niepce, Fox and Talbot, in the early days of their great discovery, might have had some dim fore-knowledge of its susceptible development, but their wildest imaginings must have fallen far short of the actual realities a few brief years were destined to divulge.

Its beginnings were limited to portraiture and pictorial representations generally, but the improvements which year by year have been added to its capabilities in this direction, have resulted also in a far wider field of action and usefulness. The naturalist, the physiologist, the archeologist, and even the philologist are to-day employing it extensively as a most useful auxiliary to their studies; while its records and revelations in bacteriology and astronomy are simply invaluable. And the limit of its usefulness is by no means reached.

These are facts worthy the attention of the skiagrapher of to-day, as they may enable him, however vaguely and narrowly, to discern the scope and range of the work he is engaged in. What nobler inducement could be offered to put forth all the care, zeal and intelligence of which he is capable, than x-ray work affords? For skiagraphy is, indeed, the crown and glory of photographic and electric efforts. Therefore, let us strive earnestly, faithfully, diligently and with singleness of purpose, so that, be the visible and tangible results what they may be to us personally, generations of men yet unborn may in time arise to bless our labors, and proclaim their and the world's indebtedness to the early pioneers in x-ray work.

BIBLIOGRAPHY.—Manual on Photography, by A. Brothers; Chemistry of Photography, by R. Meldola, F. R. A. S.; Hints on Development, by Cramer.

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COMMITTEES.

Four committees were named at the annual meeting of the Roentgen Society in December and by resolution the president was requested to name the members for these committees as early as practicable. This important matter was brought about by a resolution offered by Dr. Monell. For this reason Dr. S. H. Monell, 47 West 27th street, New York City, is named chairman of the "Committee on Standards." The importance of this work and the burden of labor being so heavy for this committee, I have asked Dr. Monell to name four associates, or six if desirable. Dr. G. P. Girdwood, Montreal, Canada, 111 University street, W. A. Price, D. D. S., Cleveland, Ohio, 2238 Euclid avenue, have already been named. In this connection I will ask of the journal readers to write to Prof. Monell offering opinions and suggestions. You are interested in the Society and in x-ray work and I trust you will feel it is your duty to write offering some opinion, limited howsoever, it may be. Write some opinion.

Committee on Scientific Research is the second committee:

Chairman: Dr. John B. Murphy, Chicago, Ill., 3305 Michigan avenue.

Dr. A. Schwab, Brooklyn, N. Y., 690 Bushwick avenue.

Prof. Elihu Thomson, Lynn, Mass.

Mr. H. Westburry, Harrison, N. J.

Mr. Nikola Telsa, New York City, 46 & 48 East Houston street.

Dr. A. Clifford, Mercer, Syracuse,

N. Y., 324 Montgomery street.

Prof. Elmer Gates, Laboratory, Chevy Chase, Md.

By early co-operation, by writing or otherwise, you can quickly reach points of understanding and congeal into a common whole the result of your labor.

Committee on Ways and Means is the third committee:

Chairman: Dr. J. Rudis-Jicinsky, Cedar Rapids, Iowa.

Dr. Thomas M. Buckley, Brooklyn, N. Y.

Dr. William Jordan Taylor, Cincinnati Hospital, Cincinnati, Ohio.

Dr. William Hailes, Albany, N. Y.

Dr. William Sprenger, New Haven, Conn.

Your labor must be concentrated rapidly as possible and will partake of some of the work of other committees, but it contemplates the practical ways and means of all that pertains to x-ray including society work.

Committee on Medico-Legal is the fourth committee:

Chairman: Dr. Mihran K. Kassabian, Philadelphia Pa., 1808 Green street.

Dr. F. Wessley Sells, Murray, Iowa.

Dr. Constantine V. S. Boetger, Ottawa, Ont. Canada.

Dr. Frank Ring, St. Louis, Mo., 612 Chemical Bldg.

E. Flieschman-Aschhiem, San Francisco, Cal.

Dr. S. D. Brooks, Surgeon, U. S. Marine Hospital, Portland, Oregon.

C. Edmund Kells, Jr., D. D. S., Medical Bldg., New Orleans, La.

Every member of this committee will have an opportunity to consult attorneys and join with them legal opinions upon all the phases of the x-ray. The greatness of the subject will give you a ready hearing with the best legal lights. The proof of the picture will be one of the chief interrogitories.

The Roentgen Society of America will meet in Buffalo, N. Y., sometime during the month of September. Two days set aside for the meeting will be named by the Committee of Arrangements during the month of April. The Committee of arrangements so far named in Buffalo is as follows:

Chairman: Edgar B. Stevens, 688 Seventh street; Dr. Elmer E. Staar, 523 Delaware avenue; Dr. Renwick R. Ross, 100 High street; Dr. James W. Putnam, 525 Delaware avenue; Secretary, Roger Cook Adams.

The committee has already convened, and in the language of Dr. Putnam: "The committee are anxious to do all possible to make the meeting a success." This assures us again a great, enthusiastic and useful meeting.

FLUOROMETER.

An English writer has given the names of several inventors who have devised accurate means for the localization of foreign bodies. Moore, Payne, Flemming and Mackenzie Davidson are mentioned and especially Remy because he has done more than others to simplify the work. It is disappointing that the invention of an American was not given consideration for his invention is equally perfect, more practical and more simple. John Dennis, of Rochester, N. Y., invented the Fluorometer and for accuracy, simplicity and convenience there is nothing yet found superior in the armory of the x-ray worker.

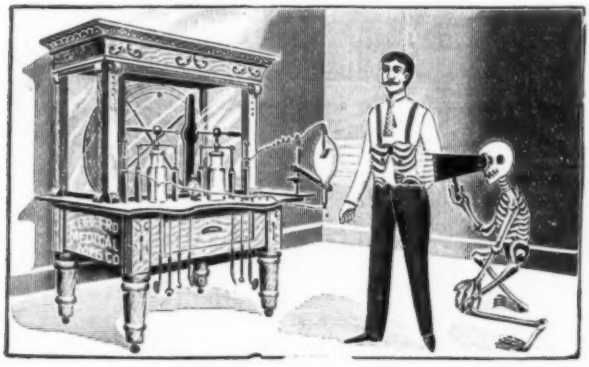
This is the age of diagnostic medicine, and therefore

X-RAY QUIZ COURSE.

It is a source of a great deal of satisfaction to us to learn that one of the great medical colleges of this country has added to their curriculus the study of the practical uses of the x-ray. The Medico-Chirurgical College, of Philadelphia, have engaged the services of Dr. Mihran K. Kassabian, one of the most painstaking and successful radiographers in the East to teach and demonstrate in this department. The college has also organized a new Army and Navy Quiz Course of four months, to prepare graduates for the army and navy. Dr. Kassabian will occupy the chair of radiographic science and art in this department also.

Clinical Notes and Comments.

Dr. T. D. Crothers, Editor, *Quarterly Journal of Inebriety*, in the January, 1901, number, writes: "Antikamnia has become one of the standard remedies, particularly in Influenza. It is prepared witn various drugs in tablet form, the latest, a laxative tablet, with quinine and some mild cathartics, called 'Laxative Antikamnia & Quinine Tablets.' All of these forms are very attractive and palatable. We have never seen a case of addiction to antikamnia, hence we prize it very highly as one of the most valuable remedies for diminishing pain without peril. We have used it with excellent results to quiet the pain following the withdrawal of morphia. We have received from this company many complimentary notices showing the vast influence it has secured among regular practitioners. The object of the antikamnia in 'Laxative Antikamnia & Quinine Tablets' besides its antipyretic and analgestic effect, is the prevention of all griping, nausea and other unpleasant effects generally produced by purgatives when administered alone."



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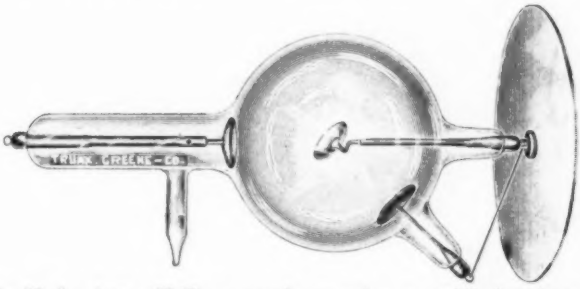

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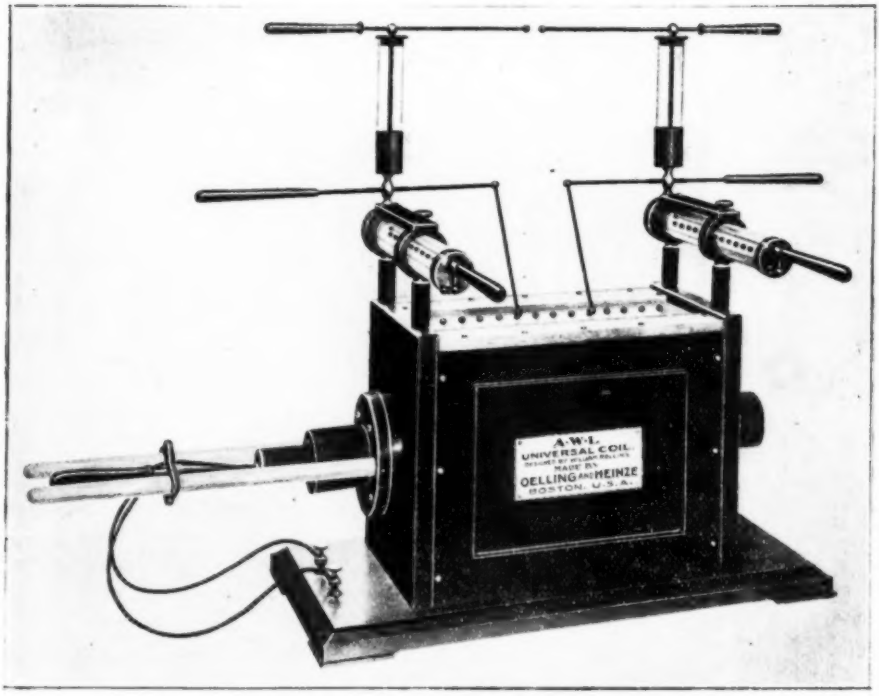

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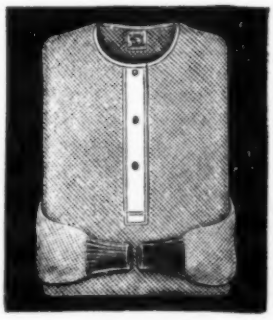

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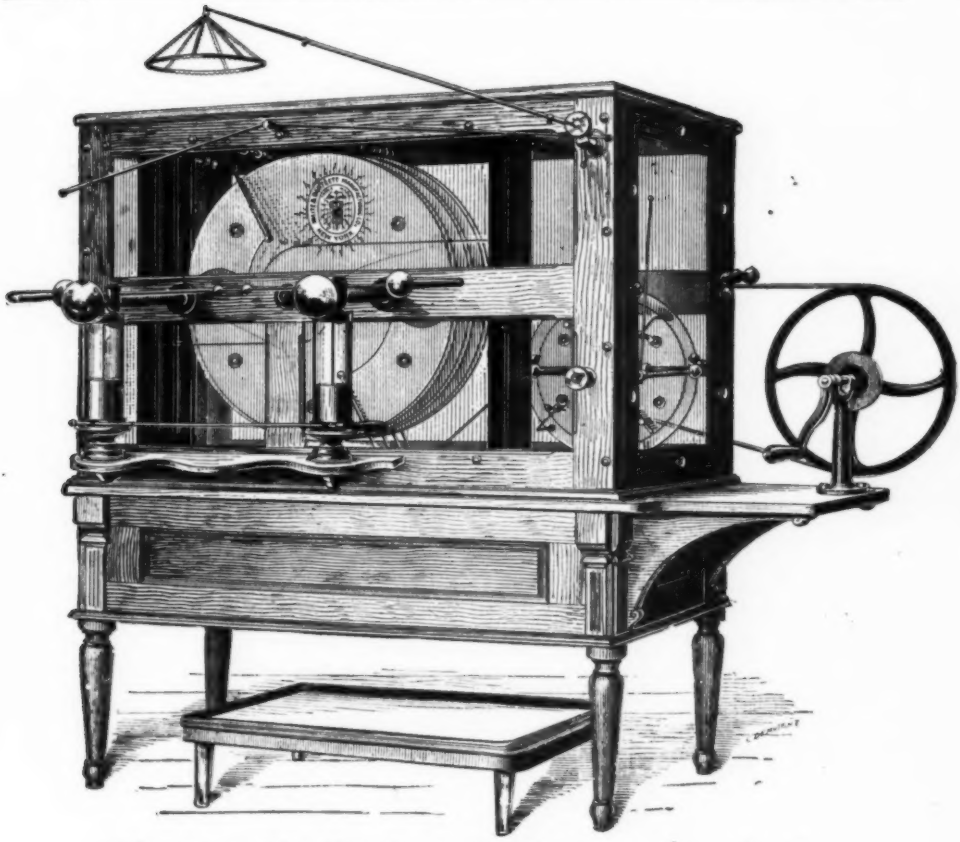

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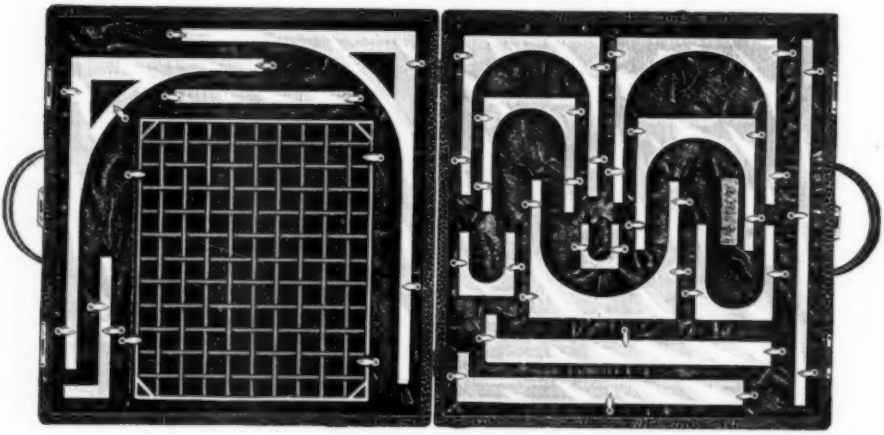

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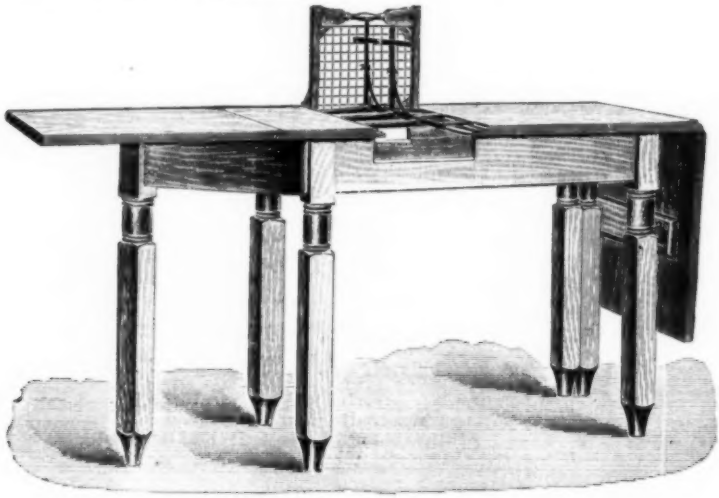

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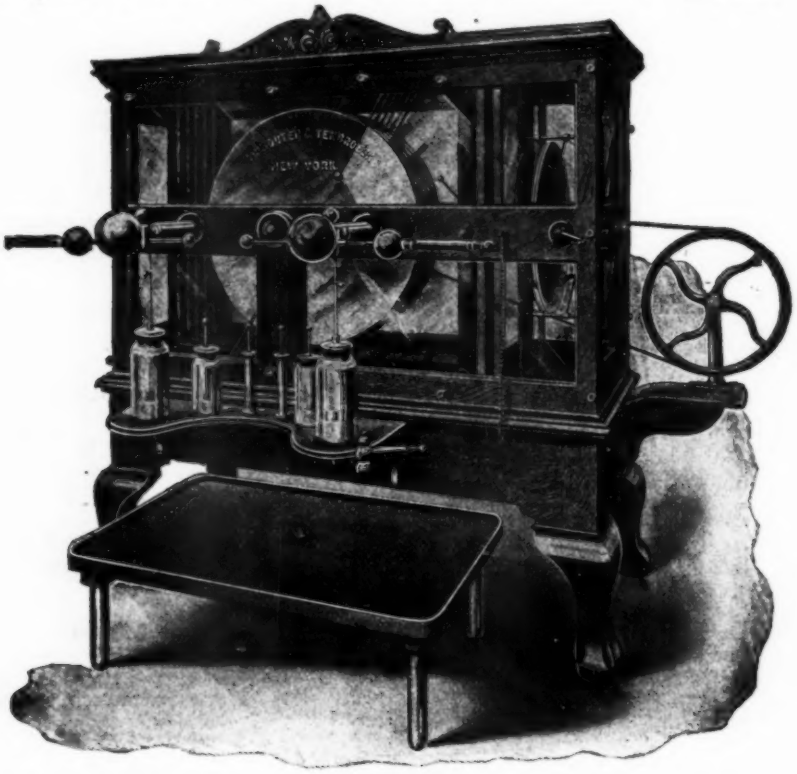

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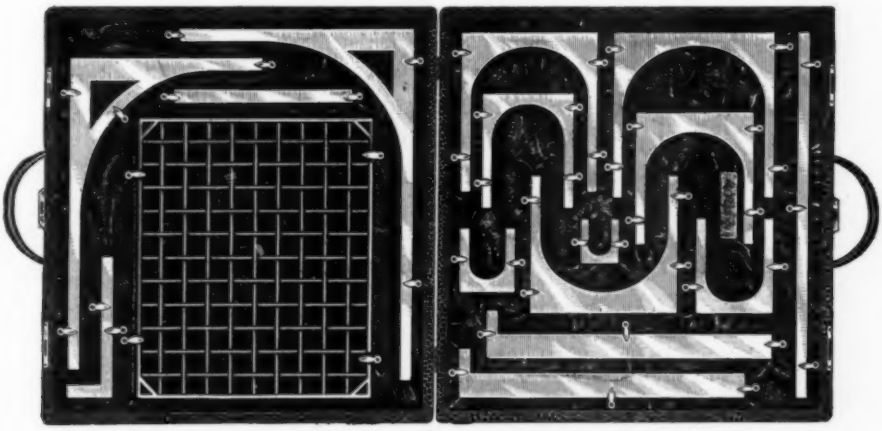

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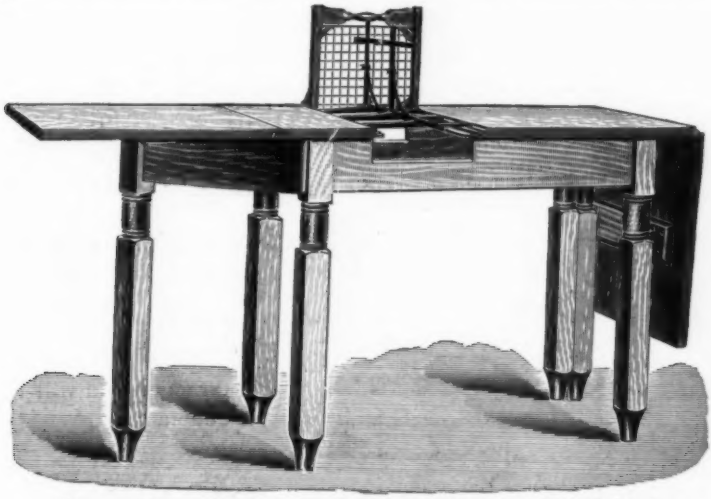

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